

## CIRCUIT BOARD INDICATORS

The time-, space-, and cost-savers for your application.

*Choosing the right indicator for your application can be challenging at times. The following circuit board indicator overview is designed to help in the decision making process and provide a snap shot of the advantages, features, and considerations for each indicator type covered.*

The challenge of PCB design engineers today is to add more functionality to a circuit board while shrinking its overall footprint. This means placing more components within a tightly constrained space while maintaining manufacturability, and achieving cost reductions becomes consistently more difficult.

### Where can design engineers find a solution to these challenges?

The answer: **Circuit Board Indicators.**

Typically, only after the active components have already been designed in and the board function has been solidly established will board indication needs be determined. However, considering indication needs, placements, and choosing the proper indicator early in the design stage can result in cost-, and space savings, improve manufacturability, and increase overall board efficiency.

Designers typically have the choice of three different circuit board indicator options:

1. [Housed Through Hole Indicators \(CBI®\)](#)
2. [Surface Mount – PRISM Indicators \(PRISM®\)](#)
3. [Light Pipes and SMD LEDs \(Optopipe®\)](#)

Each type of indicator comes with unique characteristics and attributes that can aid design engineers to solve individual or multiple design challenges.

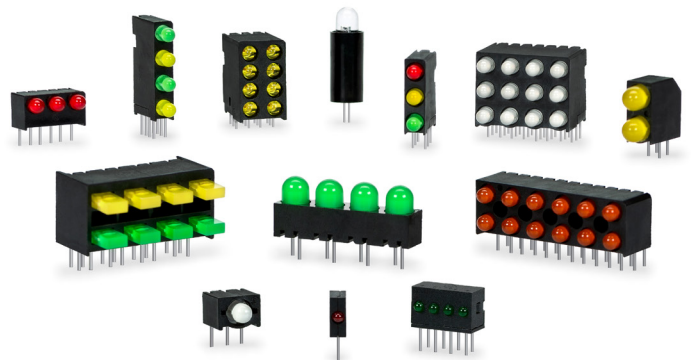
### HOUSED THROUGH HOLE CBIs (CBI®)

#### Advantages & Features

- Large number of configurations
- Uniform, and space-saving footprint
- Various lens styles and sizes
- Large selection of single-, bi-, and tri-color combinations
- 2mA low current options
- Only one insertion for arrays of indicators
- Tried-and-true indication solution

#### Considerations:

- Manual installation
- Requires wave soldering



## HOUSED THROUGH HOLE INDICATORS (CBI®)

These types of indicators contain 1 or multiple LEDs housed in a thermoplastic (PBT), low profile, housing with leads protruding from the bottom for through hole mounting on a PCB. They are cost-effective indicators with many different options and configurations for a broad spectrum of indication needs.

Housed through hole CBIs come in top view and right-angle versions. The advantage of the right-angle versions over basic discrete through-hole LEDs is that there is no need to bend the leads, which can damage the leads and lead to potential failure. The typical operating electrical currents of these indicators are 2mA (low current options), 10mA, and 20mA.



Single position, top view housed through hole CBI.



Two position, right-angle housed through hole CBI.

Most common for these types of indicators are round lenses with a diameter of 2mm, 3mm, or 5mm. Rectangular lenses are also available on certain series. Lenses can either protrude from the front panel or be recessed for backlighting indication needs. Lenses come diffused, clear, non-tinted, or color-tinted for easy identification during installation and the off-state.



4 led, RGB housed through hole CBI with protruding lens.

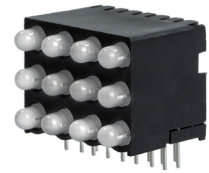


4 led, RGB housed through hole CBI with recessed lens for backlighting applications.

Housed through hole CBIs come in a broad range of single colors with custom color combinations available for the bi-, tri-, and quad-level versions. For additional color variation, 3-leaded bi-color and 4 led tri-color indicator options are also available to the design engineer.



Four position, right-angle, housed through hole CBI with recessed lenses.

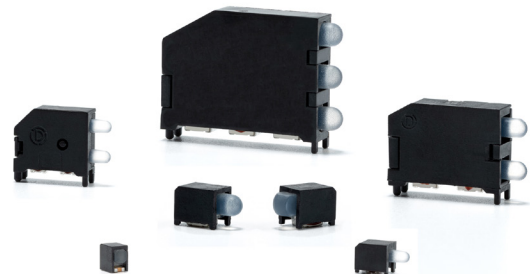


Tri-level, quad block, right-angle housed through hole CBI.

Ganged arrays up to 2 high x 6 wide and 4 high x 4 wide, are available pre-assembled, simplifying the installation process since only one insertion is needed instead of several separate ones.

The one drawback of housed through hole CBIs is that they are not pick-and-place ready and need to be installed manually and require wave soldering.

Some suppliers offer clipped or bent leads to make housed through hole CBIs surface mount processable. However, the high temperatures of the reflow process can damage the indicator leading to failure in the field. This option is therefore not recommended for through-hole LEDs.



## HOUSED SURFACE MOUNT CBIs - PRISM®

### Advantages & Features

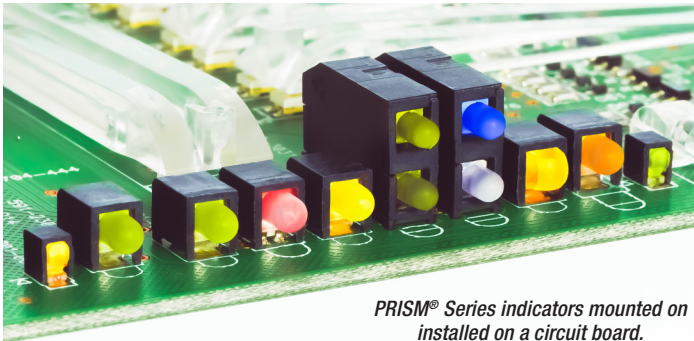
- Uniform, and space-saving footprint
- Ease of installation (pick and place SMT)
- Enhanced optical performance
- Large selection of single-, bi-, and tri-color combinations
- Single-, bi-, and tri-level vertical options
- 1.6mm, 2mm, and 3mm lens sizes
- 2mA low current options
- Reflow ready at 260°C max

### Considerations:

- Per unit cost can be higher compared to other indicators
- Fewer options than other indicators

## SURFACE MOUNT – PRISM INDICATORS (PRISM®)

These space-saving SMD indicators combine SMD LEDs, light pipes, and light shield housing in one compact indicator package. One, or multiple SMD LEDs are fused to a thermoplastic (PPA) housing containing a silicone light pipe that efficiently directs the light from its source to the front of the panel or housing.

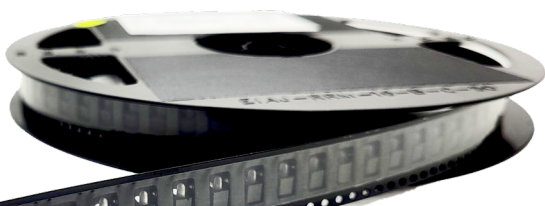


*PRISM® Series indicators mounted on installed on a circuit board.*

PRISM® CBIs are right-angle indicators that come in single-, bi-, and tri-level configurations. The typical operating electrical currents are 2mA (low current options), 10mA, and 20mA, similar to their through-hole counterparts. PRISM® CBIs offer a versatile color selection with single-, bi-, and tri-color combinations. The thermoplastic (PPA) housings of these indicators prevent light bleed and provide optimal light output.

Depending on the series, they are available with 1.6mm, 2mm, and 3mm diameter lenses in round and square configurations. The silicone lenses are diffused for enhanced optical performance and are ideal for bi-color and tri-color applications where color-mixing is desired. An additional benefit of silicone lenses is their innate flexibility, which simplifies and speeds up the panel insertion process during the final installation.

PRISM® CBIs are tape and reel packaged and are compatible with automatic pick-and-place equipment for reduced installation costs. They are highly recommended for PCBs with no mix technology i.e., reflow only designs, as the parts are designed to survive 260°C peak reflow temperatures.



*Tape and Reel packaging of 594 Series PRISM® indicators.*

The 1.6mm lens and 3.3mm maximum width make the single-level 594 and bi-level 596 PRISM series an ideal indicator for high-density applications with limited space or board-edge mounting.

**LEARN MORE**



*596 PRISM® Bi-Level Indicator*

*594 PRISM® Indicator*

Unit cost is the one disadvantage of PRISM® CBIs when viewed by itself as it is higher than either that of Housed Through Hole CBIs and Light Pipes with SMD LEDs. However, cost- and time-savings that offset the unit cost are achieved during assembly in a pick-and-place and reflow solder process.



## LIGHT PIPE (OPTOPIPE®) WITH SMD LED

### Advantages & Features

- Low cost
- Provides indication around obstacles
- High level of design flexibility
- Large selection of options
- Various lens styles and sizes
- Large selection of SMD LEDs
- Semi-customizable
- Provides ESD protection

### Considerations:

- Manual installation
- Post reflow process

## LIGHT PIPES AND SMD LEDs (OPTOPIPE®)

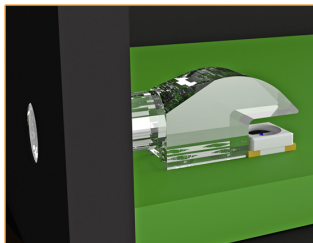
Light Pipes with SMD LEDs are a low-cost option with the most flexibility to bring indication around obstacles on the PCB to the front of the panel. They are typically used for front-panel indication when traditional indicators are too large or other space constraints exist. Sometimes indication is required over, around, or beneath front-panel components, such as ports or switches, and light pipes provide the solution to this frequently encountered problem.



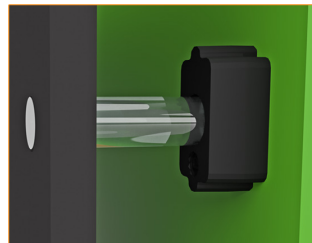
*Right-angle light pipe providing panel indication over a switch.*

This oftentimes eliminates the need for PCB or panel layout redesigns, resulting in overall cost- and time-savings.

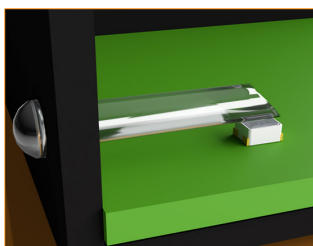
They can also be utilized when EMI/RFI concerns require the light source to be away from the front panel, or when indication needs arise after the mechanical design is completed.



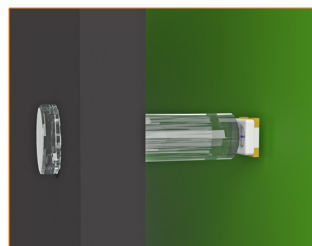
*Single position, horizontal PCB mounted light pipe.*



*Single position, vertical PCB mounted light pipe.*



*Single position, horizontal PANEL mounted light pipe.*



*Single position, vertical PANEL mounted light pipe.*

LED light pipes are available in vertical and right-angle view versions with single and multiple indication positions. They come in lens sizes from 1mm to 5mm diameter round, as well as square and rectangular shapes. Designers can choose from flat, convex, or domed lens tip styles that can either be polished or textured depending on the optical needs of the application.

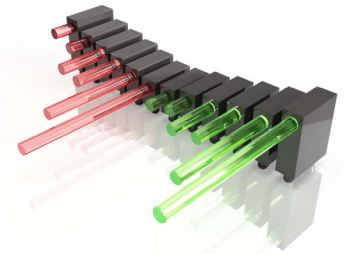
Light Pipes provide unvarying indicator illumination across different heights and lengths of the pipe. Certain pipe types are available with light shields that effectively eliminate light bleed and optical crosstalk for more efficient light transmission and output.

They are easily customizable due to the nature of their construction. For example, Dialight's X/Y variable, right-angle Optopipe® light pipes, and their vertical Optopipe® light pipe series offer the most customization options for height and length dimensions.

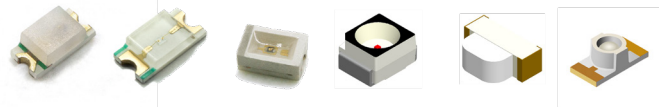
### Dialight's X/Y variable, right-angle Optopipe® light pipes.

**Available in several standard dimensions and customizable for length and height within a given range.**

[LEARN MORE](#)



The ability to choose the ideal light source is an additional benefit of utilizing light pipes with SMD LEDs for PCB indication. Here design Engineers are generally not locked into using a predetermined LED that was chosen by the CBI manufacturer, but one can instead [choose from a wide range of SMD LEDs](#). This gives the PCB designer greater flexibility when optimizing for application cost and performance.



This high level of flexibility however comes at the cost of installation speed. Light pipes with SMD LEDs require a two-step installation process that is more intensive than that of the other CBI options. First, the LED is placed and reflow soldered. Then the light pipe is placed over the LED in a secondary process before the board with indicator assembly can be mounted to the panel.

Despite the priority given to main circuit board components, proper indicator selection should not be ignored when it comes to finding design optimization solutions. There are various options available to the design engineer to aid in reducing the size of your application, streamlining its manufacturability, reducing costs, and enhancing overall application performance.

To find the right indication solution for your application, it is important to work with a supplier that has the right technical expertise, proven quality products, and a large portfolio of circuit board indicators to choose from.

**OE is Our Expertise.**

Circuit Board Indicator Comparison Chart	Housed Through-Hole CBIs	Housed Surface Mount CBIs - PRISM	Light Pipe and SMD LED
Cost per Unit	○	○	+
Options	+	○	+
Design Flexibility	○	○	+
Optical Output	+	+	○
Ease of Installation	○	+	-

Dialight Signals & Components is the world-leading supplier of Optoelectronic components. We are the leader in LED board-level through-hole and surface mount indication, including Prism® SMDs and Optopipe® Light Pipes.

Combined with our LED panel mount line and based LED bulbs, Dialight offers the widest range and most reliable of indicator products.

To view Dialight’s selection of circuit board indicators available to you please visit:

[www.dialightsignalsandcomponents.com](http://www.dialightsignalsandcomponents.com)